

# Chemistry

A degree in chemistry couples biblical principles with scientific practice—and delivers a solid foundation for scientific investigation in a multitude of careers.

Chemistry is known as the central science, because it interacts with all other sciences, and it explains the world around us.

A degree in chemistry can lead to a career in environmental science, nanotechnology, materials chemistry, sustainable and green chemistry, biotechnology, or a medical discipline.

Through our degree program, you will acquire theoretical principles and the laboratory skills you need for a career in chemistry, or a related career in which chemistry is an asset or requirement. As part of your chemistry studies, you may make aspirin in your introductory chemistry lab or test the pond water for compounds important in water quality.

Whether learning how to synthesize molecules, solving molecular structures, understanding the physical basis of chemical bonding, or understanding how a metal works when forming a mineral structure or in a catalytic biological enzyme, each class offers key principles and real-world applications. You will be trained by faculty who are experts in their individual fields and eager to share that expertise by mentoring students.

| ID       | COURSE   | CREDITS |
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| CHEM 101 | <b>CHEM 101 - Elementary Elements   2022-2023</b><br><br>This course offers non-science majors a way to rekindle their love of science in an exciting, student-centered, integrative, hands-on approach in the classroom. It seeks to explore connections between an atom and the universe, matter and its properties, how living organisms exist and survive, and how the first people in Canada interacted with their environment. It also explores how to effectively evaluate and articulate core global and local scientific issues from a chemistry vantage point. CHEM101 is a Scientific Method and Lab Research option within TWU's Core Foundations. It is also recommended for students in Elementary streamed programs within Education. | 3       |
| CHEM 103 | <b>CHEM 103 - General Chemistry I   2022-2023</b><br><br>This course is intended for students with a background of high school chemistry less than Chemistry 12 (students with Chemistry 12 normally go into CHEM 111), as an introduction to chemical concepts, where topics include: stoichiometry, the nature of solutions, acids and bases, and oxidation/reduction reactions, the gas laws, thermochemistry, the periodic table, bonding, molecular structure and descriptive inorganic chemistry.  | 3       |
| CHEM 104 | <b>CHEM 104 - General Chemistry II   2022-2023</b>   | 3       |

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|          | <p>This course is a continuation of CHEM 103. Topics include: chemical equilibrium, acids, bases and buffer systems, solubility equilibria, elementary energy concepts, electrochemistry and an introduction to organic chemistry. These concepts are discussed as far as possible in the context of their significance in life processes, in industrial process, and in the environment.</p>   |         |
| CHEM 111 | <p><b>CHEM 111 - Principles of Chemistry I   2022-2023</b></p> <p>This course considers modern concepts in the fundamental laws and principles of chemistry. Investigated topics include: stoichiometry, and chemical calculations, nature of solutions, acids and bases, and oxidation/reduction reactions, the gas laws, thermochemistry, the periodic table, bonding, molecular structure and descriptive inorganic chemistry.</p>   | 3       |
| CHEM 112 | <p><b>CHEM 112 - Principles of Chemistry II   2022-2023</b></p> <p>Modern concepts in the fundamental laws and principles of chemistry: Introduction to chemical kinetics, chemical equilibrium, acids, bases and buffer systems, solubility equilibria, elementary energy concepts, electrochemistry and an introduction to organic chemistry. These concepts are discussed as far as possible in the context of their significance in life processes, in industrial process, and in the environment.</p>  | 3       |
| CHEM 198 | <p><b>CHEM 198 - Lab for CHEM 103 and CHEM 111   2022-2023</b></p> <p>This lab course will compliment either the Chem 103 or Chem 111 lectures. It is meant to give students an opportunity to apply the learning that is happening in class in a hands-on way. The chemical concepts learned in Chem 103 or Chem 111 will be explored (topics include: stoichiometry, the nature of solutions, acids and bases, oxidation/reduction reactions, thermochemistry, the periodic table, bonding, molecular structure and colligative properties). This chemistry lab is also meant to introduce students to lab safety, common lab practices and lab techniques that will be required for upper level science courses and beyond.</p>  | 1       |
| CHEM 199 | <p><b>CHEM 199 - Lab for CHEM 104 and CHEM 112   2022-2023</b></p> <p>This lab course will compliment either the Chem 104 or Chem 112 lectures. It is meant to give students an opportunity to apply the learning that is happening in class in a hands-on way. The chemical concepts learned in Chem 104 or Chem 112 will be explored (topics include: solubility, kinetics, chemical equilibrium, organic synthesis and extraction, buffer chemistry and electrochemistry). This lab involves a special project where students will get to explore, in depth, an area of choice and present that knowledge to the class. This chemistry lab is also meant to introduce students to lab safety, common lab practices and lab techniques that will be required for upper level science courses and beyond</p> | 1       |
| CHEM 221 | <p><b>CHEM 221 - Organic Chemistry I   2022-2023</b></p> <p>An introduction to theoretical, physical, and descriptive organic chemistry. A study of the properties of aliphatic, alicyclic, and simple aromatic compounds is examined. Introductory spectroscopy. The laboratory course illustrates the operations, representative reactions, and</p>   | 3       |

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|          | syntheses of organic chemistry.   |         |
| CHEM 222 | <b>CHEM 222 - Organic Chemistry II   2022-2023</b><br>An introduction to theoretical, physical, and descriptive organic chemistry. A study of the properties of aliphatic, alicyclic, and simple aromatic compounds is examined. Introductory spectroscopy. The laboratory course illustrates the operations, representative reactions, and syntheses of organic chemistry.   | 3       |
| CHEM 230 | <b>CHEM 230 - Inorganic Chemistry   2022-2023</b><br>This course studies the chemical and physical properties of the elements and inorganic compounds using atomic orbital theory and the theory of bonding in molecules and crystalline solids. Main group element chemistry and the structure of the periodic table are emphasized throughout.  | 3       |
| CHEM 240 | <b>CHEM 240 - Physical Chemistry   2022-2023</b><br>An introduction to thermodynamics as applied to chemical reactions. Topics include: the First and Second Laws of Thermodynamics, free energy and equilibria, phase equilibria, ideal and dilute solutions of non-electrolytes.  | 3       |
| CHEM 321 | <b>CHEM 321 - Advanced Organic Chemistry   2022-2023</b><br>Methods for spectroscopic determination of structures in organic chemistry. The course covers functional chemistry of organic substances that have particular relevance to the life sciences; modern synthetic techniques for functional group transformation; principles involved in the planning and execution of multi-step synthesis of organic molecules; and, laboratory in synthetic methods and spectroscopic techniques. | 3       |
| CHEM 322 | <b>CHEM 322 - Advanced Organic Chemistry   2022-2023</b><br>Methods for spectroscopic determination of structures in organic chemistry. The course covers functional chemistry of organic substances that have particular relevance to the life sciences; modern synthetic techniques for functional group transformation; principles involved in the planning and execution of multi-step synthesis of organic molecules; and, laboratory in synthetic methods and spectroscopic techniques. | 3       |
| CHEM 332 | <b>CHEM 332 - Environmental Chemistry   2022-2023</b><br>Principles analysis and impact of chemical movement and distribution - both natural and human-induced - in natural environments focusing primarily on the hydrosphere and atmosphere. Sampling and analytical methods are included for water, soil, and air. Work is conducted both on site in natural habitats and the laboratory.  | 4       |
| CHEM 341 | <b>CHEM 341 - Advanced Physical Chemistry I   2022-2023</b><br>The fundamental concepts of matter and its structure in relation to energy. Quantum mechanics,   | 3       |

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|          | statistical thermodynamics, spectroscopy, kinetics, and the solid state are considered.  |            |
| CHEM 342 | <b>CHEM 342 - Advanced Physical Chemistry II   2022-2023</b><br>The fundamental concepts of matter in relation to: Kinetic Molecular Theory, Transport Phenomena, Elementary Kinetics, Complex Reaction Mechanisms and Catalysis.  | 3          |
| CHEM 357 | <b>CHEM 357 - Modern Analytical Methods   2022-2023</b><br>Introduction to the theory and practice of analytical chemistry. After a review of the basic laboratory techniques used in pure and applied chemistry and in biological chemistry, the course discusses a number of instrumental techniques, particularly those based on chromatographic, electromagnetic radiation, and electrochemical theories.                          | 3          |
| CHEM 358 | <b>CHEM 358 - Modern Analytical Methods   2022-2023</b><br>Introduction to the theory and practice of analytical chemistry. After a review of the basic laboratory techniques used in pure and applied chemistry and in biological chemistry, the course discusses a number of instrumental techniques, particularly those based on chromatographic, electromagnetic radiation, and electrochemical theories.                          | 3          |
| CHEM 370 | <b>CHEM 370 - Environmental Chemistry   2022-2023</b><br>The study of chemical reactions as they relate to the environment. The course takes a biogeochemical approach with emphasis placed on the deleterious effects that human activities and technologies have had on atmospheric, aquatic, and terrestrial systems. Methods to alleviate environmental problems are considered.   | 3          |
| CHEM 372 | <b>CHEM 372 - Molecular Genetics   2022-2023</b><br>This course considers modern developments and techniques in genetics, especially the basic and applied aspects of recombinant DNA technology.  | 3          |
| CHEM 384 | <b>CHEM 384 - Principles of Biochemistry   2022-2023</b><br>The study of chemical structure, function, and metabolism of carbohydrates, lipids, proteins, and nucleic acids. This class is continued as CHEM 386.  | 3          |
| CHEM 386 | <b>CHEM 386 - Biosynthesis   2022-2023</b><br>In this course, two aspects of biochemistry are developed: (1) The modern understanding of the biochemical transfer of genetic information: DNA structure and synthesis, transcription, and translation. These are related to developments in recombinant DNA technology. (2) An introduction to physiological biochemistry including vision, muscle contraction, and neurotransmission. | 3          |
| CHEM 390 | <b>CHEM 390 - Directed Individual Study   2022-2023</b>  | 1, 2, 3, 4 |

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|          | Field or laboratory study of a problem selected by the student in consultation with a professor, and presented as a written proposal in advance of the session in which the study is to be conducted. Normally, problems are outgrowths of previous coursework with a given professor at Au Sable.   |         |
| CHEM 400 | <b>CHEM 400 - Directed Studies in Chemistry   2022-2023</b><br>Students are required to produce an outline of the topic to be studied in consultation with the instructor. A course of reading and/ or experimentation is pursued according to the approved outline. Assessment may be via examination and/or a final written report.  | 2, 3    |
| CHEM 409 | <b>CHEM 409 - Thesis Preparation   2022-2023</b><br>In consultation with a faculty advisor, the student will propose a chemical research project, which will actually be investigated in the follow-up course, CHEM 410. The student must first do a thorough search of the relevant chemical literature. A specific project proposal is then to be formulated and presented in a written report.  | 1       |
| CHEM 410 | <b>CHEM 410 - Senior Thesis   2022-2023</b><br>The course follows up on CHEM 409; the research project that was proposed in CHEM 409 is actually carried out in CHEM 410. This is done under the supervision of a faculty member of the chemistry department. As a result, there are no lectures; rather the course is centered on the lab. In addition to the facilities at Trinity Western, other facilities may be utilized where possible and useful. The project will result in a written thesis and public presentation.                                     | 2       |
| CHEM 411 | <b>CHEM 411 - Senior Thesis   2022-2023</b><br>Students research a chosen area of chemistry and provide a final written report.  | 3       |
| CHEM 431 | <b>CHEM 431 - Advanced Inorganic Chemistry   2022-2023</b><br>This course looks at the chemistry of the transition metals. Emphasis during the first semester is on classical coordination chemistry, including stereochemistry, symmetry, theories of bonding and electronic structure in complexes. The second semester includes a variety of special topics in inorganic chemistry, such as organometallic chemistry, catalysis, and bioinorganic chemistry.  | 3       |
| CHEM 432 | <b>CHEM 432 - Advanced Inorganic Chemistry   2022-2023</b><br>See CHEM 431 for course description  | 3       |
| CHEM 461 | <b>CHEM 461 - Chemical Concepts in Nanotechnology   2022-2023</b><br>Nanotechnology is the use of science, engineering and technology for the design and implementation of protocols that lead to novel materials as well as devices on the nanometer size. The objective of this course will be to provide students with an introduction to the principles that underpin the synthesis, characterization and application/s of a selected range of organic and inorganic nanomaterials/nanostructures. In addition to this the ethical and safety issues that face | 3       |

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the field of nanotechnology will be given consideration.

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| CHEM 469 | <b>CHEM 469 - Polymer Chemistry   2022-2023</b><br>A study of organic and structural aspects of several polymer families, physical properties including molecular weight and distribution, solution properties of macromolecules, kinetics of polymerization in free radical, ionic, and condensation systems. Stereochemistry of polymers. Application to the properties of selected synthetic rubbers and plastics. | 3 |
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